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POOR OAK SITES MAY GROW GOOD PINE

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CATALOGING PREP

Oak-hickory forests do not produce well on the poorer ridge tops and steep southerly slopes in the southern Illinois uplands and similar nearby regions. The average sawtimber-size tree on these sites contains less than one merchantable 16-foot log (fig. 1). Any logs produced are small and often defective, and are commonly of relatively inferior species. Growth is slow, seldom exceeding 75 board-feet per acre. The stands commonly contain some white oak (*Quercus alba* L.), but hickory (*Carya* sp.), post oak (*Quercus stellata* Wangenh.), black oak (*Q. velutina* Lam.), and blackjack oak (*Q. marilandica* Muenchh.), are the chief species.

In the Ozarks of south central Missouri, shortleaf pine (*Pinus echinata* Mill.) or pine-hardwood mixtures often occur on the ridge tops and southerly slopes. On such sites, pine trees produce more logs and more money than associated hardwood species, except white oak.^{2/} Shortleaf pine is also native to the Mississippi River bluffs in southwestern Illinois. So apparently one way to better utilize the poorer upland sites in this region would be to convert the present oak-hickory stands to shortleaf pine or pine-hardwood mixtures.

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^{2/} Franklin G. Liming. Response of planted shortleaf pine to overhead release. Tech. Paper No. 105, Central States Forest Experiment Station, Columbus, Ohio. 1946.



Figure 1.--In poor oak-hickory stands such as this, conversion to mixed conifer-hardwoods may be the best forest practice.

The total acreage of poor-site oak-hickory stands that might be successfully converted to conifer-hardwood mixtures is not known. However, at least 20 percent of all upland timber types in southern Illinois may be classed as oak-hickory with low potential productivity.

Conversion may be made by either of two methods. If the stand is fairly well stocked, it may be converted gradually by cutting or girdling groups of undesirable trees and planting in the spaces thus created. But if the hardwood stand has little good growing stock, it may be clear cut and planted. Both of these methods are being tested in studies begun in April 1949 on the Kaskaskia Experimental Forest in Illinois.

TREATMENT OF THE PARTIALLY CUT STANDS

Treatment of the partially cut stands consisted of cutting three sizes of circular openings in the timber stand and planting shortleaf pine in the openings. The diameters of the openings cut were one-half, once, and twice the height of the overstory trees, averaging about 30, 60, and 120 feet. Four openings of each size were made. Pine was planted at a spacing of 6 by 6 feet. As a check, pine also was planted under the canopy of the uncut stands adjacent to the openings. (Twelve similar plots were cut and planted to eastern redcedar (Juniperus virginiana L.). But because of its relatively poor survival and slow growth, this species does not look promising and the results are not included here.)

In June of the second growing season, competing hardwood reproduction was cut from all shortleaf pine plots to insure uniform conditions. Growth of this hardwood reproduction was stimulated in the larger openings. However, release to insure early success of the planted trees was actually needed in only 3 of the 8 medium- and large-size openings and in none of the 30-foot openings.

TREATMENT OF THE CLEAR-CUT STAND

Site quality of this 17-acre compartment was better than that of the partially cut stands, and the timber volume was greater than is usually found on ridge-top and upper-slope sites. During the winter of 1948-49 all merchantable sawtimber and pole-sized trees were cut and the remaining trees, mostly culls, were eliminated. Immediately after cutting, about 750 1-year shortleaf pine seedlings and 150 2-year redcedar trees were planted per acre. The cedar was planted in scattered groups of about 25 trees each. Spacing was relatively uniform and trees were planted through the slash as well as in the open spots.

RESULTS COMPARED

At the end of three years, satisfactory survival of shortleaf pine was obtained in the 12 openings cut in the forest canopy. Here is a tabulation of the results:

| | <u>Height</u> (feet) | <u>Survival</u> (percent) |
|-------------------|-------------------------|------------------------------|
| 30-foot openings | 1.5 | 83 |
| 60-foot openings | 2.1 | 66 |
| 120-foot openings | 2.5 | 72 |

Height growth increased with increase of opening size; these height differences are statistically highly significant. Trees planted under the canopy adjacent to the openings averaged only 58 percent survival and 1.2 feet in height.

The lower average survival in the larger openings was caused by sawfly damage which was especially severe on 2 of the 8 larger plots. Omitting these plots, survival was 73 percent for 60-foot and 81 percent for 120-foot openings. No trees planted in the 30-foot openings or under the canopy showed sawfly damage.

Pine trees planted under the canopy were limber, light green in color, and did not have erect terminals. Those in the openings were erect, darker green in color, and had denser foliage. Gradations in these characteristics were in general correlated with the amount of total light received.

Three years after planting, shortleaf pine in the clear-cut oak-hickory stand had satisfactory stocking and had made good growth without release from competing natural hardwood reproduction (fig. 2). The trees ranged in height from about 2 to 7 feet. A survey of the planted trees at the end of 3 years showed an average of 619 live pine trees left per acre. Of these, 407 were entirely free from competition and would need no release in the foreseeable future; 156 were somewhat crowded and would probably need to be released in a few years; the remaining 56 trees were suppressed and probably would not recover even if released. In addition about 50 redcedar trees per acre remained; most of these were thrifty but will eventually need release.

A similar survey made after the first year showed a total of 816 live planted trees per acre. Thus, about 200 planted trees per acre had died or been suppressed beyond recovery during the second and third growing seasons. There is still a good stand of conifers present for mixture with the numerous hardwood sprouts and seedlings coming into the clear-cut area.



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Figure 2.--This area was planted to shortleaf pine 3 years ago after all the large trees were eliminated. The original stand was somewhat better than that shown in figure 1. The pole at right center is 5 feet tall.



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FURTHER TREATMENT FORESEEN

Early success of planted shortleaf pine is assured on both the clear-cut area and in the holes made in forest stands. The best growth occurred on the large clear-cut area because of the better site and greater total sunlight that reached the trees planted there.

Additional cutting will probably be needed around the perimeters of the 30- and 60-foot openings 5 to 8 years after planting if growth is to be maintained and the planted pines are to become a part of the overstory. The growth response to opening size and the estimated rate of closure of the openings indicate that pine planted in openings with a diameter at least 1-1/2 times the height of the stand will grow well for 12 to 20 years before additional cutting around the perimeter of the opening is required.

Release from natural hardwood reproduction by cutting or poisoning may be necessary both in the small openings and the large clear-cut area. Need for such treatment can be determined by inspection. The deciding factor of course will be the relative growth rates of the pine and of the natural hardwood reproduction. On poor sites planted pine has a good chance of keeping ahead of hardwood reproduction (fig. 2). On fair to good hardwood sites in southern Illinois, pine or redcedar should not be planted in competition with native hardwoods.

SUMMARY

Experiments were made to determine the best way to convert poor-site oak-hickory stands to conifer or conifer-hardwood stands in southern Illinois and vicinity. Openings of various sizes were cut in such stands and planted to shortleaf pine and redcedar. In addition, a 17-acre stand was clear cut and planted.

Results show good survival for pine on all plantings. Height growth increased with size of opening and was best by far on the large, clear-cut area. This confirms the results of a similar study reported by Liming in Missouri.² Redcedar had poor survival and early growth but the remaining trees were thrifty.

If conversion of poor-site hardwoods to conifer-hardwoods is desired and if no significant amount of good growing stock is present, the area should be clear-cut and planted to pine at once. If good growing stock timber is present and gradual conversion is desired, it should be done by cutting openings with a diameter at least 1-1/2 times the height of the overstory and planting immediately. Provisions must be made to maintain the conifer component of the mixture by cutting hardwoods if they compete seriously.